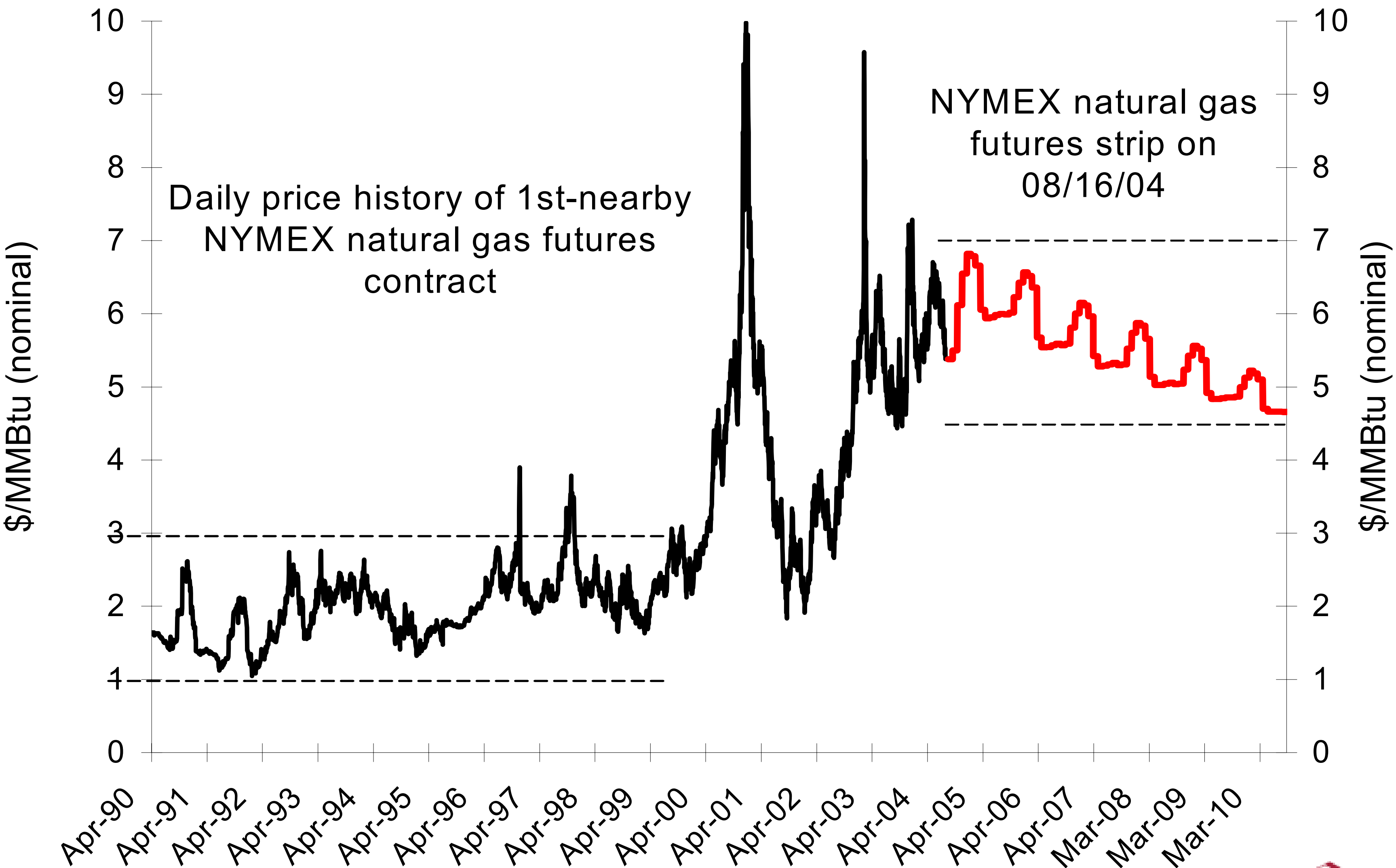
# The Value of Renewable Energy as a Hedge Against Fuel Price Risk

**Ryan H. Wiser**
Lawrence Berkeley National Laboratory
RHWiser@lbl.gov (510-486-5474)
http://eetd.lbl.gov/ea/EMS/

World Renewable Energy Congress
Denver, Colorado

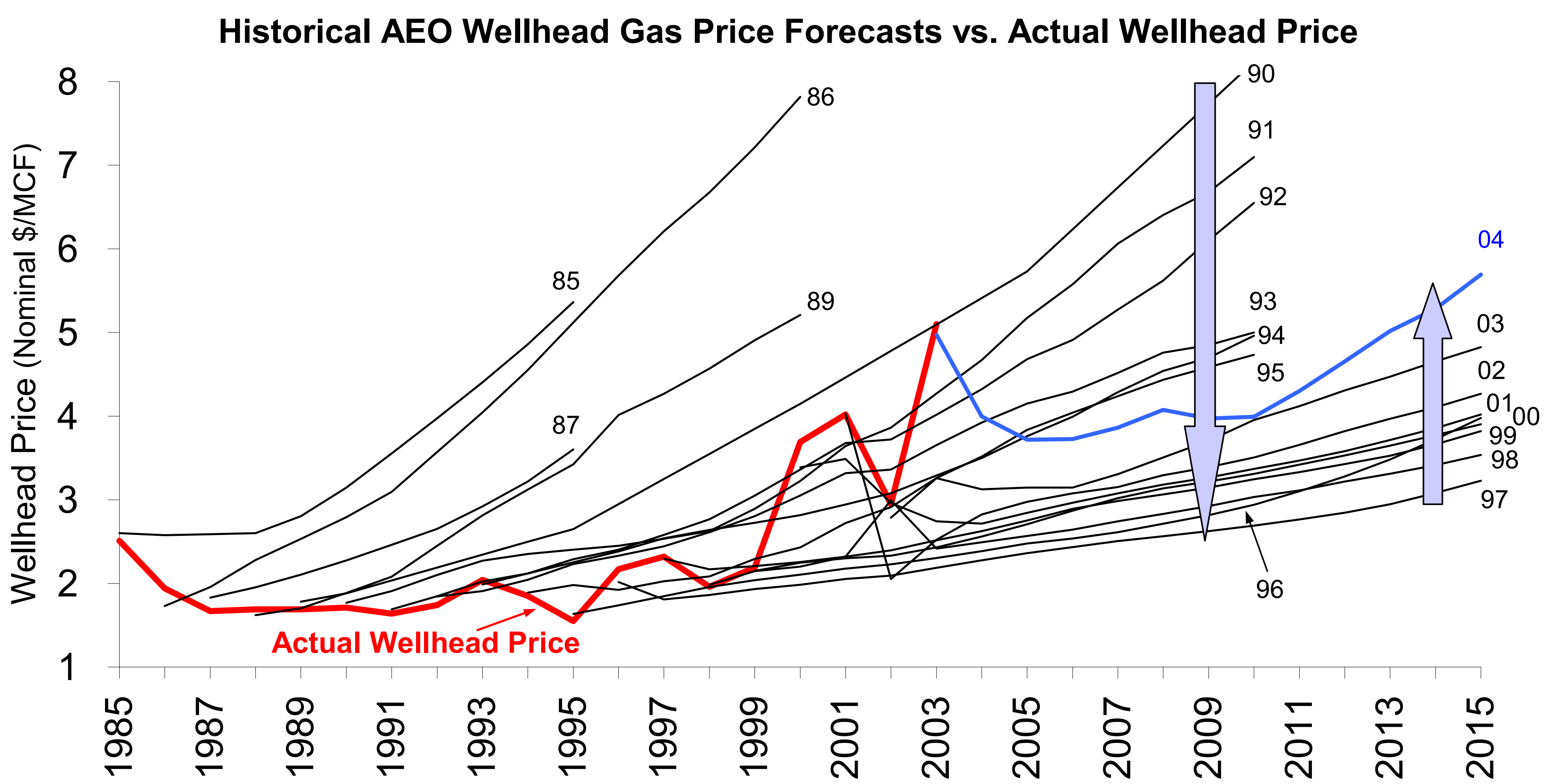
August 31, 2004

# Natural Gas Prices Are High and Volatile



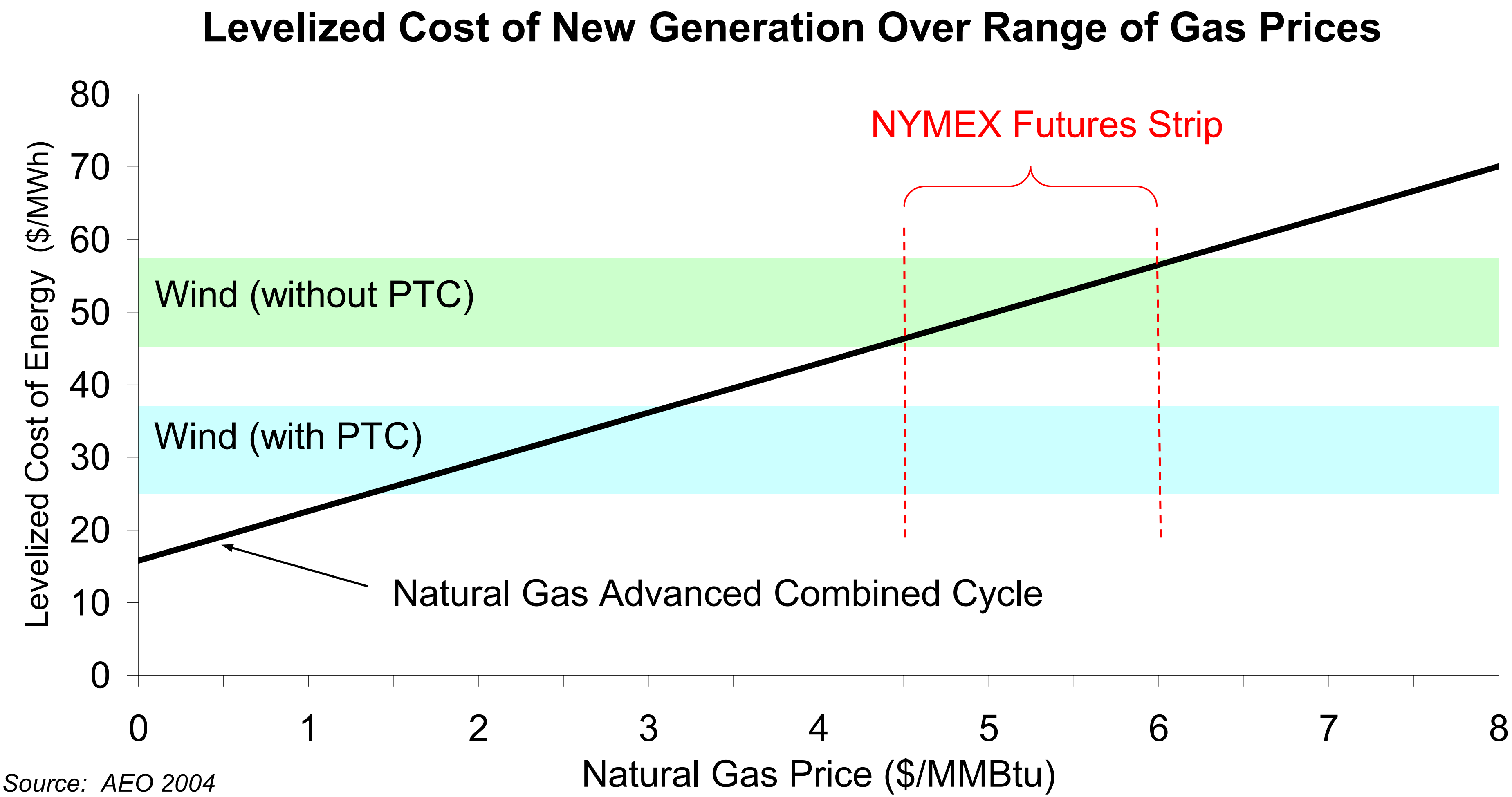

*Source: NYMEX*

# Future Gas Prices are Highly Uncertain




Source: *EIA*

# RE is Cost-Competitive at High Gas Prices




*Source: AEO 2004*

# The Hedge Value of Renewable Energy

- Renewable energy (RE) provides a hedge against volatile and escalating natural gas prices:

  1) **Mitigates Fuel Price Risk:** Unlike natural-gas-fired electricity generation, the cost of RE is not tied to the cost of natural gas

  2) **Reduces Natural Gas Prices:** Increased RE reduces natural gas demand, and may consequently put downward pressure on gas prices

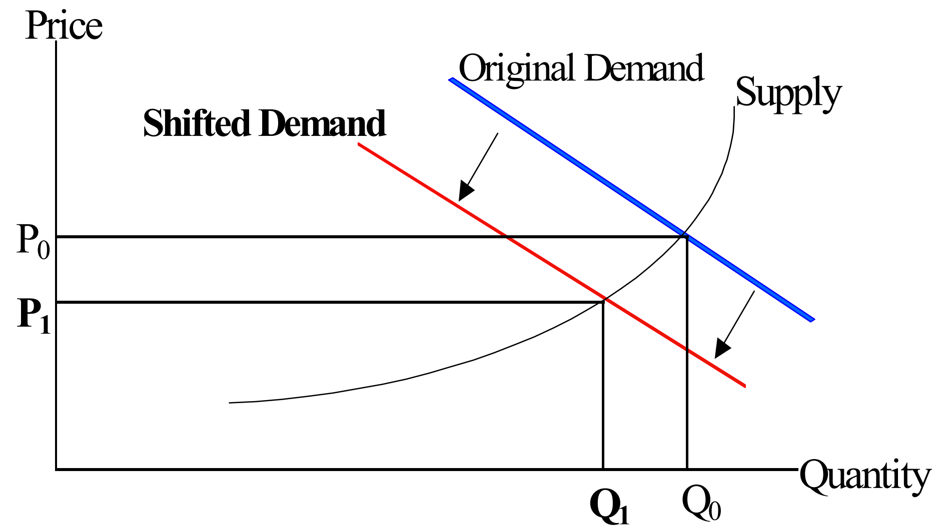
**WREC paper addresses both of these possible benefits, but this presentation discusses research on just the second benefit**

# Project Objectives

- ***Review economic theory*** to better understand the impact of natural gas demand reduction on natural gas prices
- ***Review previous modeling*** studies that have evaluated this effect, illustrating potential positive impacts of RE on natural gas prices and consumer energy bills
- ***Compare the results*** of various modeling studies to each other, and to the economics literature, to test for consistency over time, across models, and with economic theory
- ***Determine whether*** existing models are treating this effect within reason, focusing on national impacts (regional impact analysis to come later)
- ***Develop a simplified method*** for estimating the impact of RE investments on natural gas prices, without using a complex, integrated national energy model

# The Theory

- Increased use of RE will reduce natural gas demand, placing downward pressure on gas prices




- Magnitude of price reduction depends on the shape of the gas supply curve: impact expected to be larger in the short-term than in the long-term due to short-term supply constraints

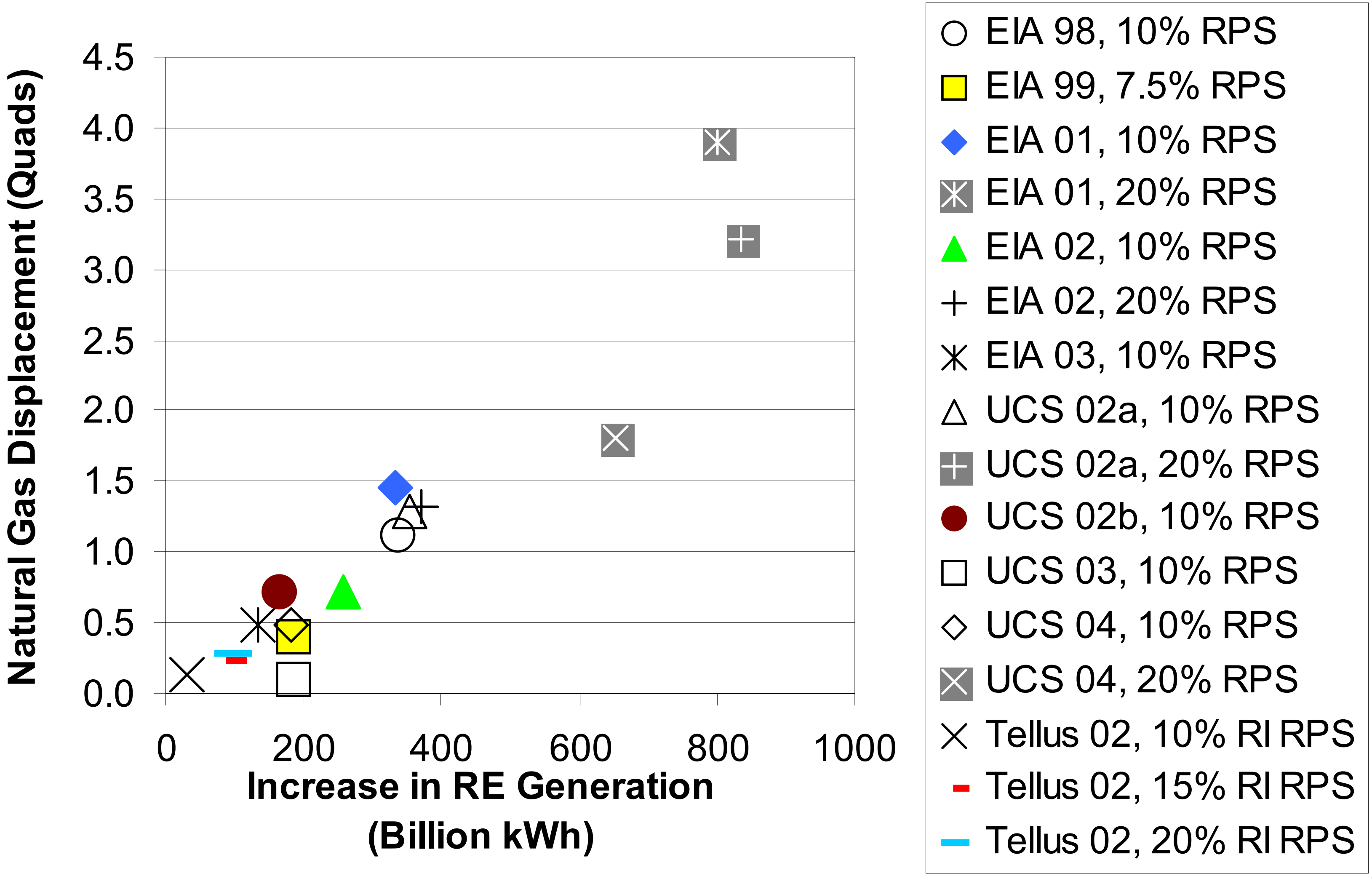
- Price reduction ***not strictly a gain in net social welfare*** – it is a gain to gas consumers that comes at the expense of producers; whether such transfers support government intervention is subject to debate

# An Overview of Previous Studies

- A large number of recent modeling studies have evaluated the impact of increased RE and EE deployment on gas prices
- Our analysis reviews results of 12 of these studies
  - 5 EIA studies of the impact of a national RPS, two of which model multiple RPS scenarios
  - 5 UCS studies of the impact of a national RPS, two of which model multiple RPS scenarios and one of which includes aggressive EE
  - 1 Tellus study of the impact of New England RPS (focus on RI)
  - 1 ACEEE study of the impact of national RE/EE deployment
- All use NEMS, except ACEEE, which uses EEA

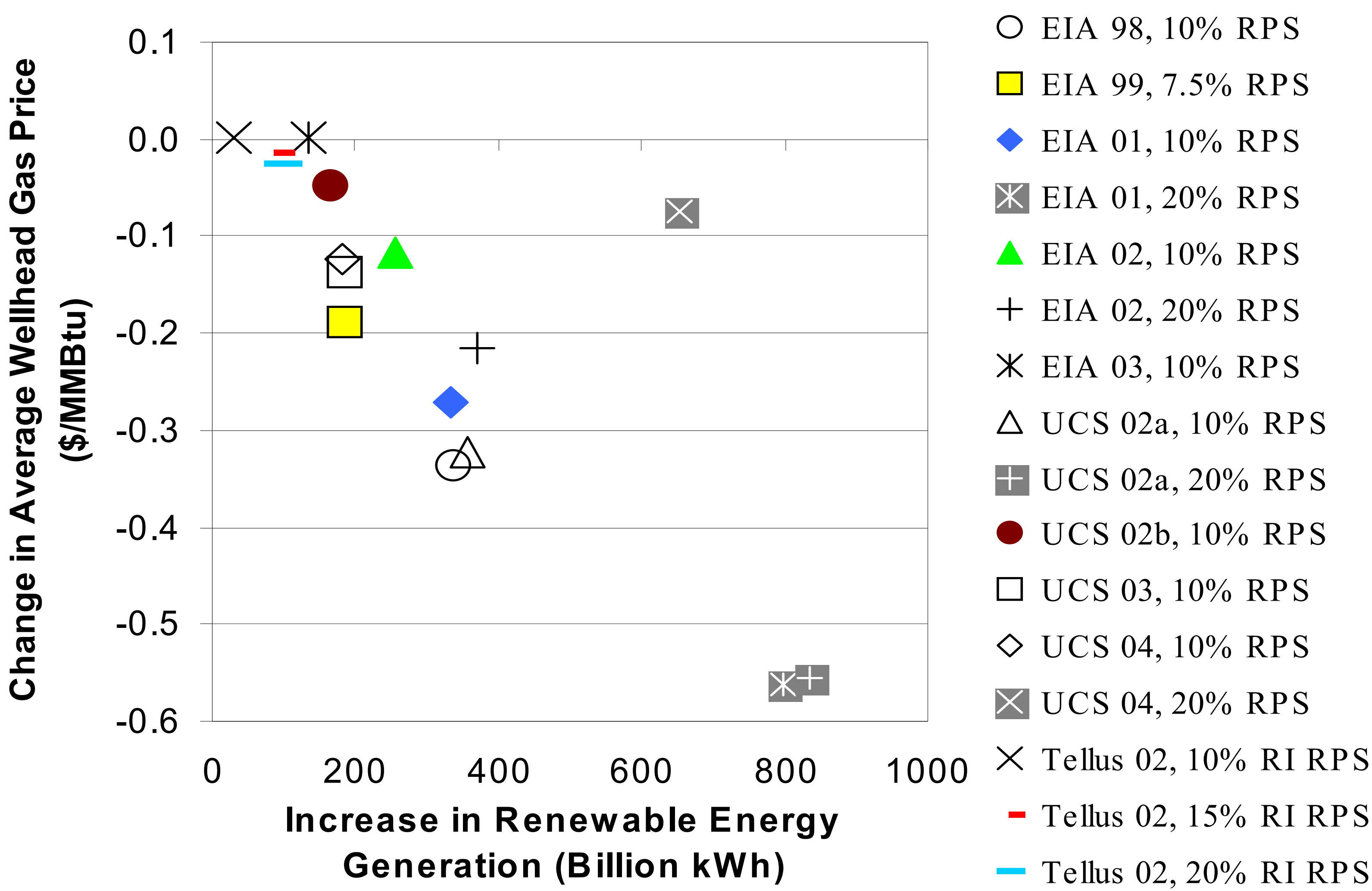
# Increased Renewable Energy Penetration Displaces Natural Gas

## Projected Gas Displacement in 2020 Under RPS Studies



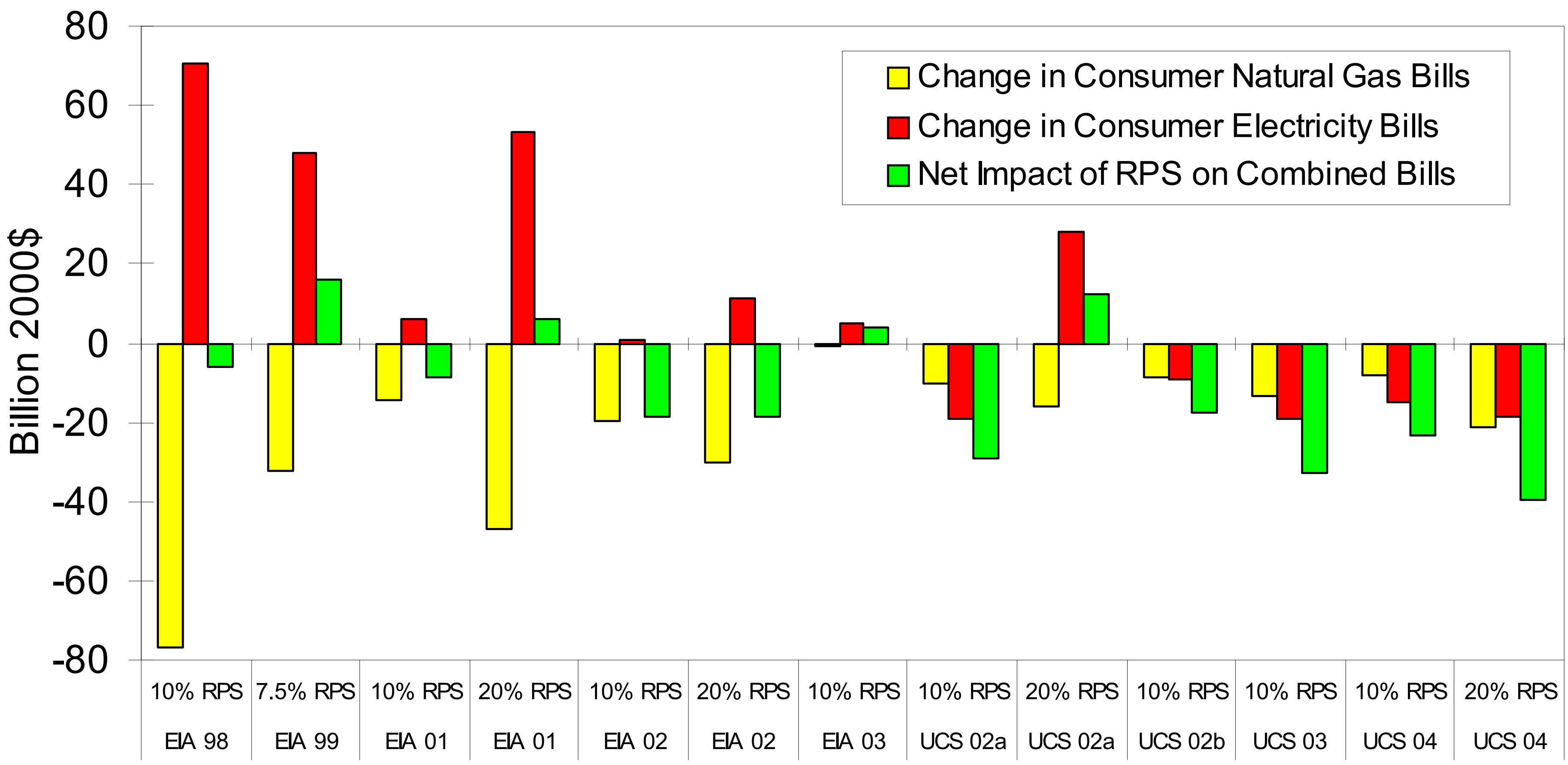
# Increased RE Penetration Reduces Wellhead Natural Gas Prices

## Projected Gas Wellhead Price Reduction in 2020 Under RPS Studies



# Consumer Gas Bill Reductions Substantially Offset Any Increase in Electricity Bills

## Net Present Value of RPS Impacts on Natural Gas and Electricity Bills (1999-2020, 5% real discount rate)

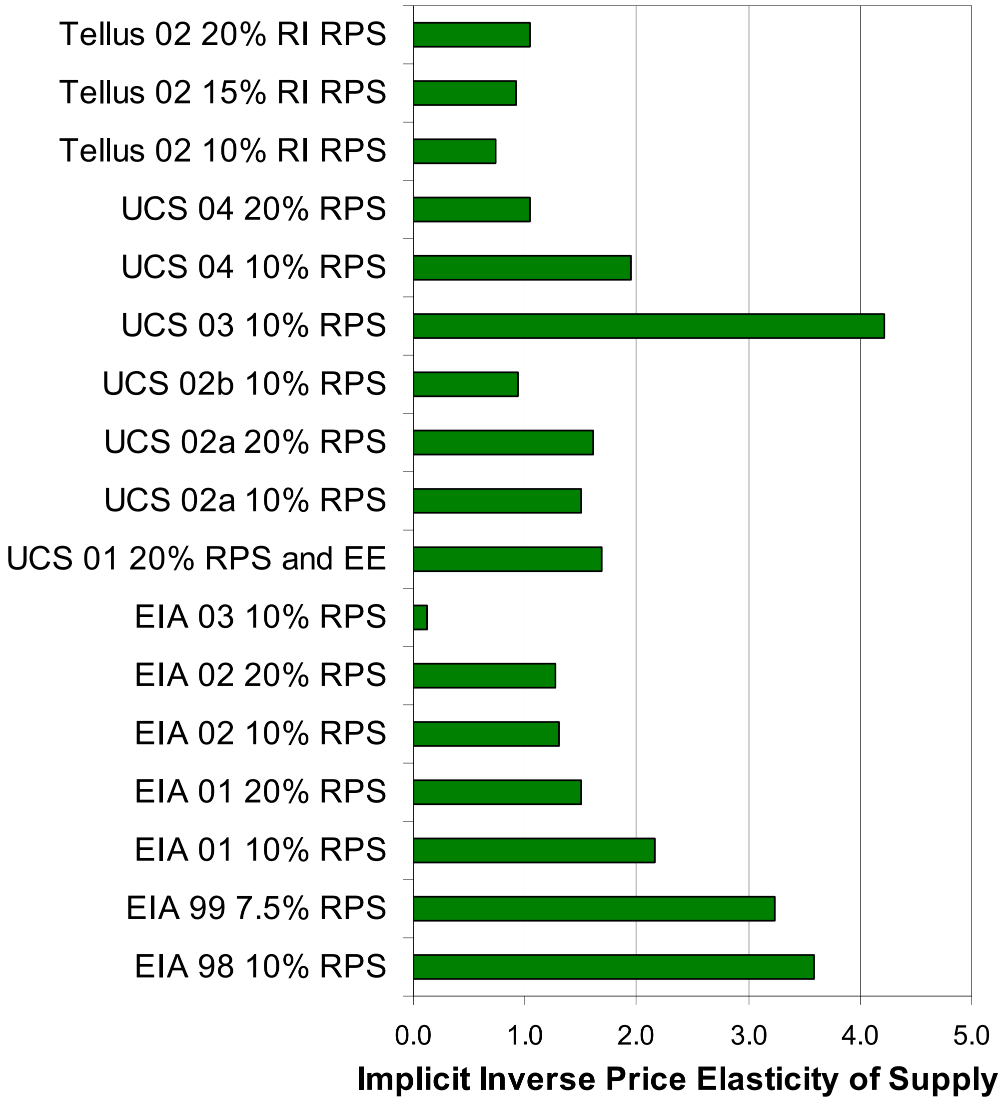


# Tests for Model Consistency

**Inverse price elasticity of supply defined as %ΔP/%ΔQ, and measures shape of gas supply curve**

**Long-term average inverse elasticity for EIA, UCS, and Tellus varies from less than 0.5 to over 4 depending on the study: central tendency 0.75 – 2.5**

**ACEEE reports short-term elasticities that are well above this range**



# Benchmarking to Other Models, Markets, Data

- Models suggest that **1% drop in gas demand** could lead to **0.75% – 2.5% reduction in long-term wellhead prices**, with some models predicting larger effects especially in the short term
- These results for NEMS are somewhat consistent with:
  - NEMS AEO economic growth cases
  - Implicit elasticities embedded in a number of other energy models
  - Limited empirical literature on historical elasticities for non-renewable energy commodities
- Many uncertainties remain, but central tendency of NEMS output is broadly consistent with limited existing knowledge
- Findings imply that, while a wealth transfer and not a net social gain, the effect of RE on gas prices is significant: **a reduction in gas bills due to increased RE could largely offset any expected incremental cost of RE to consumers**

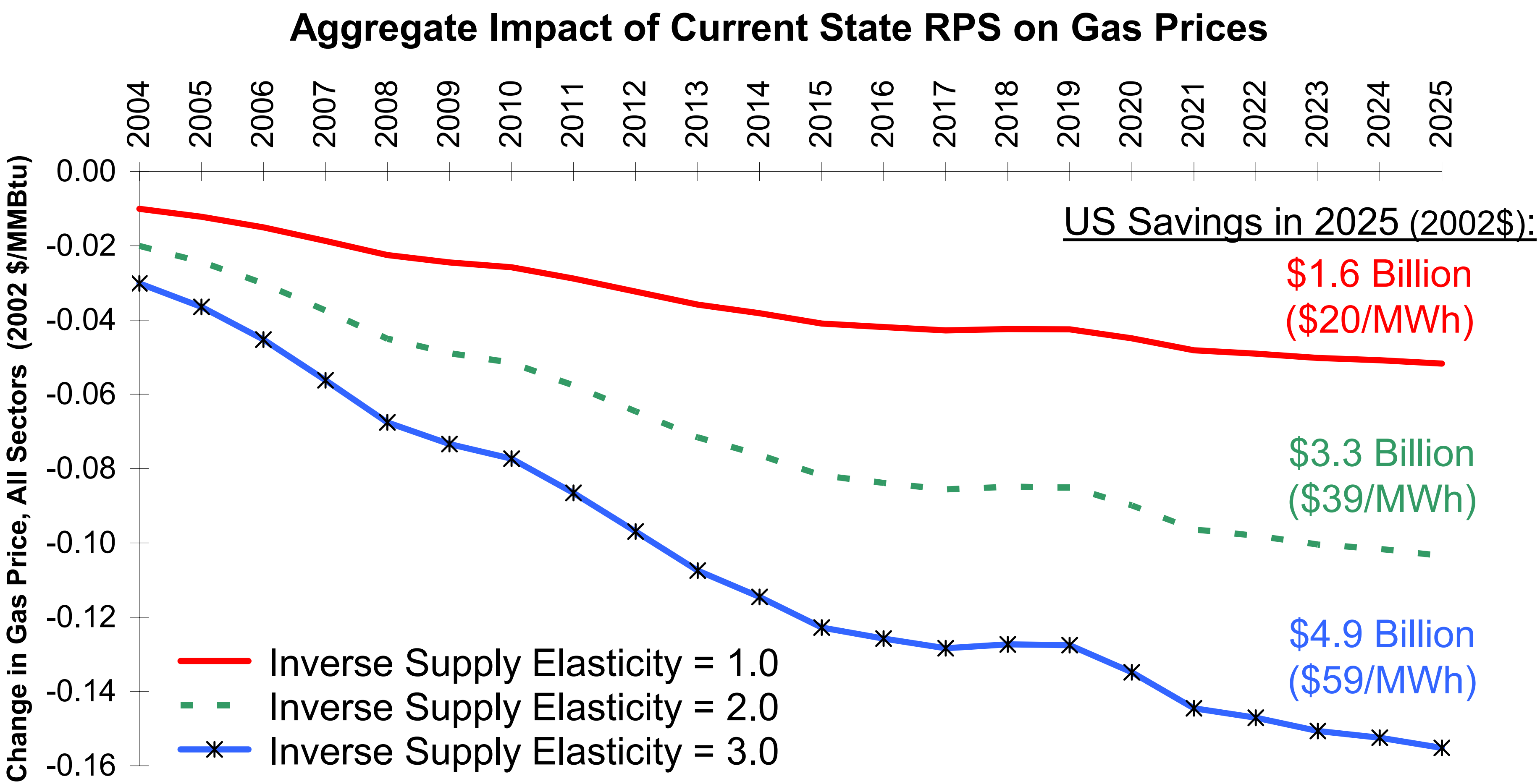
# Simplified Method – Inputs

**Despite central tendency, variation in implicit elasticities across models and years, combined with dismal historical ability to predict gas prices and uncertainty in shape of supply curve, imply that little weight should be placed on any *single* model result**

*"Model" results, without having to run the model!*

- Gas Displacement (1 MWh RE/EE = 0.6 MWh Gas-fired)
- Heat Rate of Displaced Gas Generation (7,500 Btu/kWh)
- US Gas Consumption Forecast (from AEO)
- Inverse Elasticity of Supply (range from +1 to +3)
- US Gas Wellhead Price Forecast (from AEO)
- Wellhead to Delivered Prices (1:1)

# Example Results: Impact of Existing State RPS Policies, ~16,000 MW of New RE



# Conclusions

- Gas prices are high, volatile, unpredictable
- Diversification with RE can help hedge these risks:  in addition to directly hedging gas costs, increased RE is expected to reduce gas consumption *and prices*
- Modeling studies show that a 1% drop in gas demand may lead to a long-term 0.75% - 2.5% drop in gas prices (and possibly a larger near-term drop)
- While a wealth transfer, not a net gain, this implies consumer gas bill savings from increased RE equivalent to > $20/MWh under most reasonable scenarios
- Size of potential consumer benefit, and wide range of modeling output, suggest that additional work is necessary

# Contact Information

**Ryan H. Wiser**

Lawrence Berkeley National Laboratory

1 Cyclotron Road, MS 90-4000

Berkeley, California 94720

RHWiser@lbl.gov

510-486-5474

**Reports available at:**

http://eetd.lbl.gov/ea/ems